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STUDIES IN NORTH AMERICAN HYPHOMYCETES—I

THE GENERA RHINOTRICHUM AND OLPITRICHUM

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(WITH PLATES 37–39, CONTAINING 40 FIGURES)

This group of fungi is a heterogeneous mass of unrelated genera and species and seems to have been rather studiously avoided by American mycologists. The literature on the North American species is exceedingly rare. Several genera of leaf parasites have been studied but otherwise little has been done in the group. Pound and Clements* have re-arranged the whole group with reference to the North American species.

Many species are known to be the conidial stages of ascomycetes and should be excluded from the group. The following genera contain species that have been definitely associated with other fungi, *Oidium, Polythrincium, Verticillium, Diplocladium, Dactylium, Mycogone,, Acrostalagmus, Sepedonium, Isaria, Hadrotrichum, Oedocephalum.*

Some genera are autonomous but a study of their structure and their fructification shows that their affinity is with other groups. Among such genera are the following: *Microstroma, Myxotrichum, Aspergillus, Penicillium, Zygodesmus.*

With our limited knowledge of this perplexing group it is better to defer the arrangement of it until a more exhaustive study of the genera and species has been made.

* Minn. Bot. Studies 9: 644–673. 1896. Ibid. 726–738. 1897.

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My thanks are due to Dr. N. L. Britton, of the New York Botanical Garden, for permission to examine the collection in the herbarium, and to Mr. Sydney Prentice, of Pittsburgh, for assistance in making the drawings. The kind assistance of other persons is acknowledged in the proper place under the discussion of different species.

RHINOTRICHUM Corda, Ic. Fung. 1: 17. 1837

Physospora Fries, Summa Veg. Scand. 495. 1849.

Type species, *Sporotrichum rubiginosum* Fries.

ORIGINAL DESCRIPTION: Flocci erecti, septati, supra verrucosi; sporis simplicibus verrucis innatis, dein deciduis et hylo instructis. Fries describes the genus *Physospora* as follows: Flocci caespitosi, septati, persistentes, demum laxi, sporis vesiculosis, simplicibus, e floccorum verrucis enatis adspersi.

Type species, *Rhinotrichum simplex* Corda.

Saprophytic or parasitic(?); mycelium creeping, septate, intricately interwoven, forming a loose or sometimes rather dense stratum; fertile branches erect or suberect, simple or branched; spores simple, colorless or slightly colored, borne on spicules (sterigmata) on the ultimate divisions (basidia) of the fertile branches.

Rhinotrichum canescens Speg., parasitic on leaves, has been reported from Paraguay. If this is a true *Rhinotrichum* it is the only parasitic species known. All other known species grow on decaying wood or stems, usually on the under side.

The genus *Physospora* is not necessary, as the species under it may well be included under the genus *Rhinotrichum* as defined above. The difference lies chiefly in the swollen divisions of the fertile branches of the former. But all branches are not swollen, some are attenuated as in some species of *Rhinotrichum*.

Either *Physospora* must be reduced to synonymy or else the species *R. Curtisii* and *R. ramosissimum* must be transferred to *Physospora*. The differences in this case are not sufficient to justify two distinct genera.

The genera *Rhinotrichum* and *Botrytis* are somewhat related. In the latter the spores are clustered at the tips of the fertile branches, while in the former the spores are more or less scattered on the ultimate division or divisions of the fertile branches.

The genus *Sporotrichum* is also closely allied to *Rhinotrichum*, the chief difference being the procumbent fertile branches of the former. It is possible that a study of the described species of *Sporotrichum* will add a number of species to *Rhinotrichum*.

KEY TO THE SPECIES

Spores globose or nearly so.	
Spores smooth.	
Stratum reddish-brown.	1. *R. rubiginosum.*
Stratum yellow-rust color.	2. *R. subferruginosum.*
Stratum yellow to brown.	
Spores large, 15–16 μ.	3. *R. fulvum.*
Spores smaller.	
Stratum yellow.	4. *R. Curtisii.*
Stratum yellow-brown.	5. *R. laevisporum.*
Spores not smooth.	
Spores granular.	6. *R. armeniacum.*
Spores roughened, 5 μ.	7. *R. carneum.*
Spores roughened, 8–10 μ.	8. *R. subalutaceum.*
Spores not globose.	
Stratum white to cinereous.	9. *R. repens.*
Stratum sulphur-colored.	10. *R. sulfureum.*
Stratum light-brown.	11. *R. bicolor.*
Stratum light-yellow.	12. *R. tenerum.*
Stratum tan-yellow.	13. *R. ramosissimum.*

1. **Rhinotrichum rubiginosum** (Fr.)

Sporotrichum rubiginosum Fries, Syst. Myc. 3: 417. 1829.
Physospora rubiginosa Fries, Summa Veg. Scand. 495. 1849.

Stratum very thin, cespitose, reddish-brown, rubiginose; hyphae septate, branching, 6–8 μ thick; fertile branches erect, simple or branched, ultimate divisions usually swollen, sometimes attenuate, bearing the smooth, concolorous, globose-obovoid, 11–15 μ spores.

On bark and wood.

SPECIMENS EXAMINED: Canada, *Ellis Collection 1623;* New York, *Peck.*

2. **Rhinotrichum subferruginosum** sp. nov.

Stratum thin, floccose, bright yellow-rust color, ferruginous; hyphae branched, septate, 8–10 μ thick; fertile branches erect or suberect, branched, attenuated upwards or ultimate divisions swollen; spores borne on several divisions of the fertile branches, smooth, globose, colored, 14 μ.

On bark, woodpile, Hope, Jamaica, October 25, 1902.

SPECIMENS EXAMINED: Jamaica, *Earle 93* (type).

The type specimen is at the New York Botanical Garden.

3. RHINOTRICHUM FULVUM Berk. & Curt. Grevillea 3: 108. 1874

Stratum thin, fulvous; hyphae septate; fertile branches septate, ultimate divisions elongate, with spicules; spores subglobose, granular, 15–16 μ.

SPECIMENS EXAMINED: South Carolina, *Ravenel* (type, spores only).

The description is compiled largely from the original, as the material at hand was too meager for proper study. It seems very near *R. Curtisii*. *Rhinotrichum Thwaitesii* var. *fulvum* Grove is reported from England. It has verrucose spores, 7–10 μ.

4. RHINOTRICHUM CURTISII Berk. Grevillea 3: 108. 1875

Rhinotrichum Sumstinei Peck, Bull. Torrey Club 34: 103. 1907.

Stratum effused, thick, golden-yellow, brownish in older specimens; hyphae branched, septate, 8–12 μ thick; fertile branches erect, branched, septate, ultimate divisions usually swollen, covered with spicules; spores globose or subglobose, smooth, variable in size, 12–16 μ.

On decayed wood.

SPECIMENS EXAMINED: New York, *Peck;* Pennsylvania, *Sumstine;* Ohio, *Kellerman;* South Carolina (type).

In the original description, *Aspergillus laneus* Schw. is given as a synonym. The specimen in the Academy of Sciences, Philadelphia, marked *Aspergillus laneus* is too scanty for proper identification and therefore the real relationship between these two species could not be definitely determined.

Rhinotrichum Sumstinei does not seem to be specifically different. The size and the shape of the spores agree with *R. Curtisii*. The color is given as "tawny-brown." The type at Albany and the cotype in the Carnegie Museum, Pittsburgh, were examined.

The color of this species as well as of other species depends very much upon the exposure to the sunlight. When exposed to strong sunlight the color becomes darker, even brown. In a shady or secluded place the lighter shades of yellow predominate.

5. **Rhinotrichum laevisporum** (Cooke)

Zygodesmus laevisporus Cooke, Grevillea 6: 139. 1878.

Stratum thin, effused, ochraceous yellow-brown; hyphae sparingly branched, septate, 6–8 μ thick; fertile branches erect, septate, apex swollen with few spicules, frequently the ultimate and penultimate divisions with spicules; spores globose, smooth, 10–14 μ.

On decayed wood.

SPECIMENS EXAMINED: Louisiana, *Ravenel 58.*

This species is near *R. Curtisii.* The few spicules chiefly distinguish it from that species.

6. RHINOTRICHUM ARMENIACUM Berk. & Curt. Grevillea 3: 108. 1875

Stratum thin, yellow to yellow-brown; hyphae branched, spinulose, occasionally portions smooth, septate, 6–8 μ thick; fertile branches spinulose, attenuate upwards, septate (?); spores globose, colored, granular, 14–15 μ.

On decayed wood.

SPECIMENS EXAMINED: South Carolina, *3011* (type).

The authors characterize it as, "Forming a thin apricot-colored stratum; flocci ascending, articulated, the ultimate joints much elongated, granulated; spores globose."

The color apparently is yellow or yellowish-brown. The spinulose hyphae and larger spores separate it from *R. subalutaceum.*

7. RHINOTRICHUM CARNEUM Ellis & Ev. Jour. Myc. 1: 93. 1885

Stratum loose, floccose, dull-white at first, then flesh-colored; hyphae 6–8 μ thick; fertile branches obtusely rounded at the apex, with minute spicules, septate; spores globose, delicately spinulose, 5 μ.

On decayed wood.

SPECIMENS EXAMINED: Canada, *Macoun;* Oregon, *Carpenter 125* (type).

A study of better material may place this species in some other genus.

8. RHINOTRICHUM SUBALUTACEUM Peck, Ann. Rep. N. Y. State Mus. 34: 51. 1881

Stratum thin, effused, yellow-brown, alutaceous, paler on the margin; hyphae branched, intricately interwoven, smooth, septate, 8–12 μ thick; fertile branches generally short, sometimes elongate, non-septate, usually abruptly narrowed at the apex, which bears the minute spicules; spores concolorous or lighter, globose, under high power of the microscope slightly roughened or echinulate, 8–10 μ.

On decayed wood.

SPECIMENS EXAMINED: Iowa, *Holway 295;* New York, *Peck* (type).

The type was collected in the Helderberg Mountains, N. Y. The species is readily distinguished by the short fertile branches.

9. RHINOTRICHUM REPENS Preuss; Sturm, Deutsch. Fl. 6: 43. 1862

Stratum thin, effused, white to cinereous; hyphae creeping, septate, branched, 6–8 μ thick; fertile branches erect, septate, simple, equal or slightly attenuate upwards; spores ovoid-ellipsoid, smooth, 12–16 μ, occasionally with nucleus or with granular appearance.

On decayed wood.

SPECIMENS EXAMINED: Massachusetts, *Farlow* (in the herbarium of Dr. Fairman 1086).

10. RHINOTRICHUM SULFUREUM Ellis & Ev. Bull Torrey Club 11: 18. 1884

Stratum effused, thin, pale sulfur-colored, nearly white at first; hyphae branched, septate, 7–8 μ thick; fertile branches erect, simple, septate, some gradually attenuate above, others equal or somewhat enlarged, several divisions bearing spicules; spores obovoid-ellipsoid, granular, 9–10 × 11–15 μ.

On decayed wood.

SPECIMENS EXAMINED: Iowa, *Holway 296* (possibly part of the type); New Jersey, *Ellis 1662;* New York, *Fairman 1088.*

The New Jersey specimen is very thin, brownish-yellow, spores 11 × 16 μ. The color may be due to age.

11. **Rhinotrichum bicolor** sp. nov.

Stratum effused, thin, light-brown to alutaceous, dirty-white on the margin; hyphae branched, septate, hyaline or slightly col-

ored, 6–8 μ thick; fertile branches long, simple, erect, attenuate upwards, the ultimate divisions spiculiferous; spores obovoid-ellipsoid, smooth, colored, 8–10 by 10–16 μ.

On decayed wood.

SPECIMENS EXAMINED: New York, *O. F. Cook 244;* Pennsylvania, *Sumstine* (type), *Ellis & Harkness 3331.*

The margin is white or dirty-white, the brown color appearing near the center. Part of the original collection is deposited at the New York Botanical Garden. The type is in the Carnegie Museum, Pittsburgh.

12. **Rhinotrichum tenerum** sp. nov.

Stratum effused, thin, sometimes collected in rather thick patches, light-yellow, almost white on the margin; hyphae septate, branched, with numerous H-shaped formations, 5–6 μ thick; fertile branches erect, septate, attenuate upwards, the last few divisions bearing the prominent spicules; spores globose-ellipsoid, hyaline or nearly so, smooth with granular contents, 8–11 × 10–15 μ.

On decayed wood.

SPECIMENS EXAMINED: Louisiana, *Langlois 2479.*

The specimens are in the Ellis collection in the New York Botanical Garden and are labeled *Rhinotrichum tenerum* E. & E. n. sp. I was unable to find any published description of this species and have presumed that the name has not been published. The following descriptive note is found on the label: "Hyphae hyaline, septate, branched, evanescent, 5–6 μ thick, the terminal segments spiculiferous and bearing the globose, subelliptical, yellowish, hyaline, 8–10 μ, smooth conidia with granular contents."

13. RHINOTRICHUM RAMOSISSIMUM Berk. & Curt. Grevillea 3: 108. 1875

Stratum effused, thick or sometimes thin, yellow, alutaceous, tan-colored hyphae branched, septate, 8–10 μ thick; fertile branches erect, branched, septate, ultimate divisions elongate or swollen, covered with spicules; spores obovoid, frequently apiculate, smooth, variable in size, 8–12 × 13–16 μ.

On decayed wood.

SPECIMENS EXAMINED: New Jersey, *Ellis;* New York, *Peck;* Pennsylvania, *Sumstine;* South Carolina (type).

In the collection at Albany, Peck marked a specimen var. *marginatum*. It has a light-yellow margin, but otherwise agrees with the type.

This species is exceedingly variable in color and in size of spores, although the shape of the spores is rather uniform. The species is, no doubt, cosmopolitan.

DOUBTFUL SPECIES

1. *Rhinotrichum herbicolum* Ellis and Dearness, Proc. Canadian Inst. 1: 90. 1897. "Effused, light yellow, becoming brown in the centre. Hyphae, coarse, septate, branched, nearly hyaline, 8–10 μ thick. Fertile hyphae, sub-undulate above, tips swollen and bearing the globose, sub-hyaline, finely echinulate, 7–9 μ conidia.

"On dead stems of *Solidago canadensis,* London, Can., Aug., 1895."

The species is said to differ from *R. Curtisii* in its coarser hyphae and in its smaller echinulate conidia. The specimen in the Ellis collection in the New York Botanical Garden, which is probably a part of the type collection, shows the spores clustered at the apex of the fertile branches. Better material is necessary before its proper place can be determined. It resembles in many respects *Botrytis fulva* Link.

2. *Rhinotrichum bellum* Berk. & Curt. Grevillea 3: 108. 1875. "Vivide aurantiacum, effusum; sporis oblongo-ellipticis.

"Dead wood, Ala. Beaumont 4865."

No specimen of this species was examined by me and so far as known it has not been found since its first discovery.

3. *Rhinotrichum pulveraceum* Ellis; Kellerman, Jour. Myc. 1: 47. 1885. "Forming a thin pale, yellowish white, subgranulose layer on the matrix; hyphae much branched, the ends swollen and smooth; the conidia (appearing at first inside these swollen ends and pushing out through the investing membrane?) variable in size and shape, globose, 5–9 μ in diameter or elliptical, 5–12 $\times$ 5–7 μ. The elliptical conidia mostly with a slight apiculus at one end. The branching hyphae are sparingly septate and mostly not over 3 μ in diameter.

"Peculiar in the smooth swollen tips. The sterile hyphae form

a thin, white, soft layer like a Corticium on the surface of the wood.

"On dead wood and bark. Topeka, Kansas."

The type is not accessible and the description not clear enough for exact determination.

EXCLUDED SPECIES

1. *Rhinotrichum fusiferum* Berk. & Curt. Grevillea 3: 108. 1875. The original description is exceedingly short and might apply to a number of fungi.

"Dull yellow, flocci short, inarticulate, studded above with the fusiform spores, .0016′–0015′ long.

"A very pretty species. Car. Inf. 4964."

The part of the type specimen sent from Berkeley's herbarium was too meager for identification. A number of fusiform spores 5–36 μ were found in the material. The spores seemed granular or even warted and some seemed to be septate. Too little is known about this species to assign it definitely to any genus.

2. *Rhinotrichum breve* Berk. & Curt. Grevillea 3: 109. 1875. The label also bears the name *Aspergillus affinis*. The spores in the type specimen agree very well with the description but the attachment of the spores could not be satisfactorily determined. It evidently does not belong to the genus *Rhinotrichum*. The specimen was collected in South Carolina.

3. *Rhinotrichum doliolum* Pound and Clements, Bot. Sur. Neb. 4: 5. 1896.

"Effused, white, compact, velvety, gray, or drab; sporophore ascending much branched; filaments hyaline, tortuous, many septate, 5 μ wide, thickly beset with bottle-shaped basidia, 7–8 × 3–4 μ, generally opposite, rarely alternate; conidia 2–several on each basidium, borne on short sterigmata, hyaline, ovoid-ellipsoid 3–5 × 2–3 μ.

"Forming a thick crust on the sporangia and stipes of a slime mould, bluffs of the Missouri river, Bellevue (4381)."

This species evidently does not belong to *Rhinotrichum* as defined in this paper. The basidia(?) with 2–several spores point to the genus *Olpitrichum*. The type specimen has been lost or destroyed.

My thanks are due to Dr. Clements, of the University of Minnesota, and Dr. Bessey, of the University of Nebraska, for information concerning this species.

4. *Physospora elegans* Morg. Jour. Cinc. Soc. Nat. Hist. **17**: 44. 1875. Not *Physospora elegans* Cav. "Effused thin, flocculose, then pulverulent, bright ochraceous; hyphae long, slender, creeping, septate, dilute ochraceous, much branched and interwoven, producing everywhere short erect inflated vesicles. These vesicles ellipsoid, obovoid, or quite irregular, 14–20 × 9–12 mic. bearing at the apex usually two (1–3) spores on short blunt pedicels; spores globose, ochraceous 16–20 mic. in diameter.

"Growing on rotten oak trunks. Preston, Ohio."

The type specimen is no longer in existence but through the kindness of Dr. Macbride, of the University of Iowa, the original drawing made by Mrs. Morgan was sent to me for examination. The species is remarkable for the many clamp connections in the hyphae. It is closely allied to the genus *Zygodesmus*. Possibly it would be better to establish a new genus for this species.

5. *Rhinotrichum muricatum* Ellis and Ev. Proc. Acad. Phila. 86. 1891. The specimen in the New York Botanical Garden labeled with this name is very clearly not a *Rhinotrichum*.

6. *Rhinotrichum corticioides* Cooke, Grevillea **13**: 27. 1883. The specimen was collected in South Carolina by Ravenel. It belongs to the Thelophoraceae, probably *Hymenochaete Ellisii* Berk. and Cooke. Part of the type was examined.

7. *Rhinotrichum macrosporum* Farlow. See under the genus *Olpitrichum*.

8. *Rhinotrichum tenellum* Berk. & Curt. See in a later paper under the genus *Gonatobotrys*.

9. *Rhinotrichum cucumerinum* Berk. & Curt. See in a later paper under the genus *Gonatobotrys*.

OLPITRICHUM Atkinson, Bot. Gaz. **19**: 244. 1894

Saprophytic; mycelium septate, branched, interwoven; fertile branches erect, simple or branched, septate, ultimate divisions with flask-shaped fusoid or irregular processes (sterigmata) at the top bearing the simple, hyaline or pale-colored spores.

Type species, *Olpitrichum carpophilum* Atkinson.

This genus bears some resemblance to *Rhinotrichum* as the author states: "It is *Rhinotrichum* but with inflated basidia which are constricted at the point of union with the hyphae." In the original description the irregular spore-bearing processes are called basidia but to me the term sterigmata seems more appropriate.

KEY TO THE SPECIES

Spores very irregular.	1. *O. carpophilum.*
Spores regular or nearly so.	2. *O. macrosporum.*

1. OLPITRICHUM CARPOPHILUM Atkinson, l. c.

Stratum thin, white, or slightly colored; hyphae branched, septate, creeping, 5–8 μ thick; fertile branches erect, simple or branched, septate, bearing at the apex flask-shaped, fusoid, or enlarged processes (sterigmata) irregularly scattered or gregarious; spores ovoid-oblong, hyaline or pale-colored, irregular, 13–16 $\times$ 18–30 μ.

On *Gossypium herbaceum.*

SPECIMENS EXAMINED: Alabama, *Atkinson* (type).

The spores are exceedingly variable in shape and size. Very irregular bodies are developed on some of the fertile branches. The real nature of these bodies is not known. A careful examination did not reveal anything that resembled sterigmata.

I am indebted to Professor Atkinson, of Cornell University, for a slide of the type material.

2. **Olpitrichum macrosporum** (Farlow)

Rhinotrichum macrosporum Farlow; Sacc. Michelia 2: 148. 1880.

Stratum effused or pulvinate, sordid-white; hyphae branched, septate, 8 μ thick; fertile branches erect, remotely septate, slightly colored, bearing near the apex irregular or sometimes branched processes (sterigmata); spores ovoid or obovoid, smooth, hyaline or slightly colored, 16 $\times$ 30–35 μ.

SPECIMENS EXAMINED: Louisiana, *Ellis Collection 1653.*

The specimens in the Ellis collection were evidently communicated by Dr. Farlow and in all probability are part of the original collection.

The principal difference between the two species is in the form of the spores. When more and better material is studied these two species may prove to be the same.

HIGH SCHOOL,
PITTSBURGH, PA.

EXPLANATION OF PLATE 37 (frontispiece)

All the figures on this and the following plates were drawn with the aid of the camera lucida and are highly magnified. The drawings show the fertile branches and the spores unless otherwise indicated.

1–2. *Rhinotrichum rubiginosum* (Fr.) Sumstine.
3–5. *Rhinotrichum subferruginosum* Sumstine. From type.
6–11. *Rhinotrichum Curtisii* Berk. 9 and 10, from type material; 7, from type of *R. Sumstinei* Peck.
12. *Rhinotrichum fulvum* Berk. & Curt. From type material. Spores only.

EXPLANATION OF PLATE 38

1–2. *Rhinotrichum laevisporum* (Cooke) Sumstine.
3–4. *Rhinotrichum armeniacum* Berk. & Curt. From type material.
5. *Rhinotrichum carneum* Ellis & Ev. From type material.
6–9. *Rhinotrichum subalutaceum* Peck. From type material.
10. *Rhinotrichum repens* Preuss.
11–12. *Rhinotrichum sulfureum* Ellis. & Ev. 11, possibly from part of type.
13–15. *Rhinotrichum bicolor* Sumstine. From type.

EXPLANATION OF PLATE 39

1. *Rhinotrichum tenerum* Ellis & Ev. Type.
2–6. *Rhinotrichum ramosissimum* Berk. & Curt. 4, from type material.
7–11. *Olpitrichum macrosporum* (Farlow) Sumstine.
12–13. *Olpitrichum carpophilum* Atkinson. From type material.